BRITISH STANDARD

BS 449-2: 1969

Incorporating amendments issued January 1970 (AMD 416), May 1970 (AMD 523), December 1970 (AMD 661), April 1973 (AMD 1135), July 1975 (AMD 1787), August 1984 (AMD 4576), May 1988 (AMD 5698), December 1989 (AMD 6255) and Amendment No. 9

Specification for

The use of structural steel in building —

Part 2: Metric units

UDC 693.814:624.016.7:669.14.018.29

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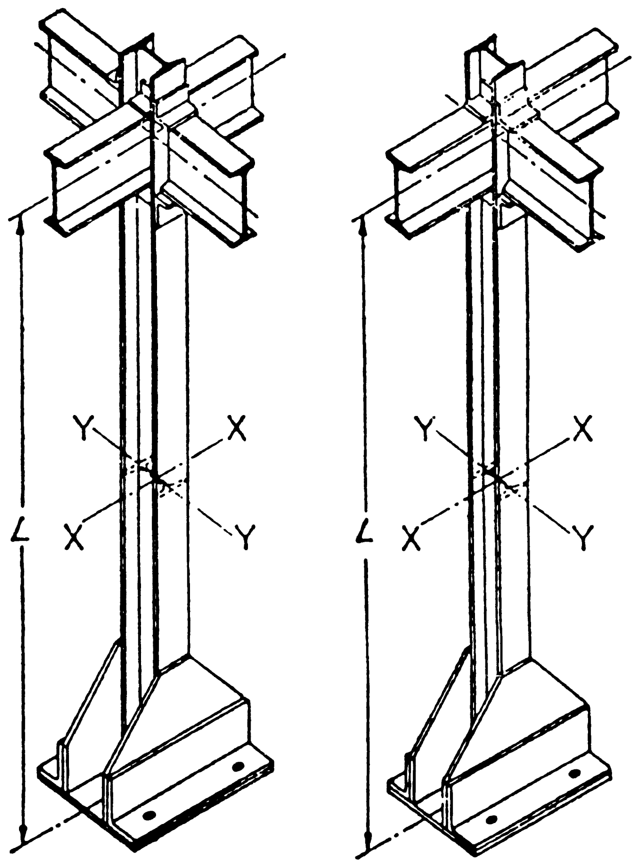
Stanchions effectively held in position and restrained in direction at both ends in respect of the weaker axis.

Effective length of stanchions = 0·7L

Slenderness ratio for design = $\frac{0{\cdot}7L}{r_y}$

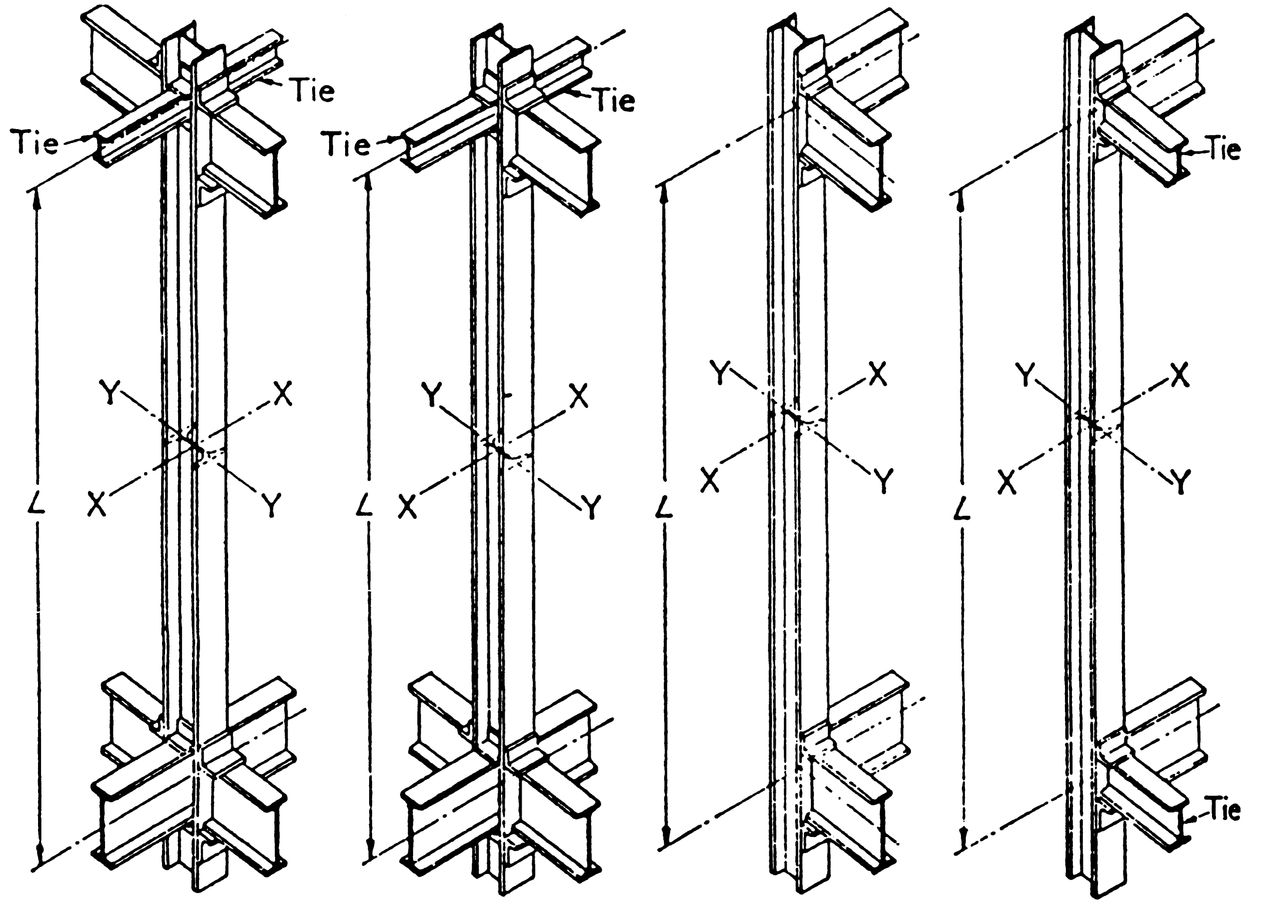


Substantial base

NOTES. Beams are all load-carrying.
Beams forming pairs to be of approximately equal size and span and carrying approximately equal loads.
Beams framing into the web of the stanchion to have moment connections.
All beams to be securely held at their remote ends.
The foundation shall be capable of affording restraint commensurate with that of **the base.**

Figure 7 — Effective length of stanchions
Bottom length of stanchions

This end is not effectively restrained in direction about the Y–Y axis.



This end is effectively restrained in direction about both axes.

Corner stanchions

Stanchions effectively held in position at both ends and restrained in direction at one end.

Effective length of stanchions = 0·85*L*

Slenderness ratio for design $= \dfrac{0{\cdot}85L}{r_y}$

NOTES. Beams are load-carrying except tie beams.
Beams forming pairs to be of approximately equal size and span and carrying approximately equal loads.
All beams shall be securely held at their remote ends.

Figure 8 — Effective length of stanchions
Continuous intermediate lengths or top lengths of stanchions

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Stanchions effectively held at both ends in position but not restrained in direction (except at the base when this is substantial).

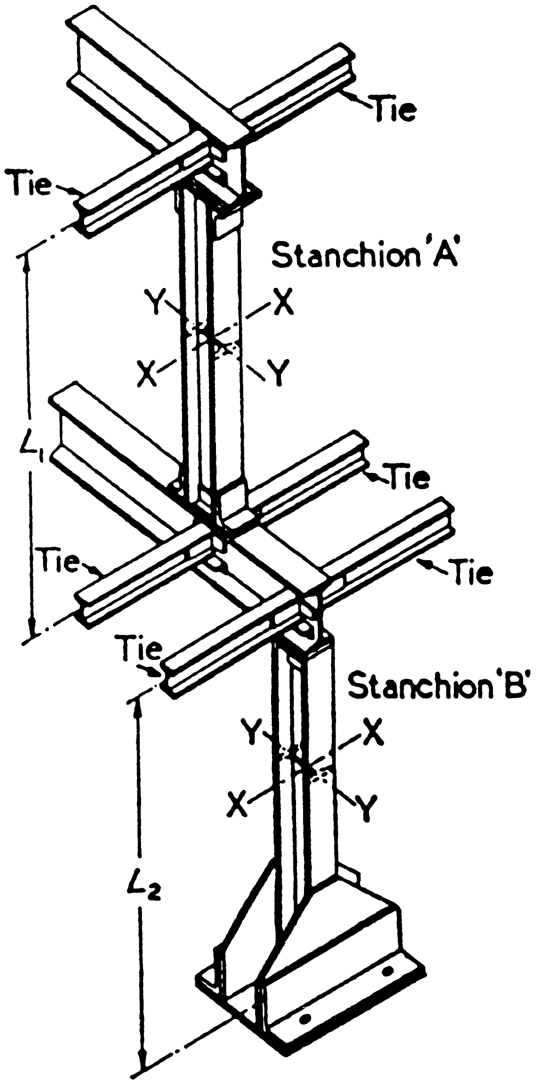
Effective length for stanchion ' A '
$= 1 \cdot 0L_1$

Effective length for stanchion ' B ' with a small riveted base or slab base **$= 1 \cdot 0L_2$**

Effective length for stanchion ' B ' with a substantial riveted base
$= 0 \cdot 85L_2$

Slenderness ratio for the design of stanchion ' A ' $= \dfrac{1 \cdot 0L_1}{r_{1y}}$

Slenderness ratio for the design of stanchion ' B ' $= \dfrac{1 \cdot 0L_2}{r_{2y}}$ or $\dfrac{0 \cdot 85L_2}{r_{2y}}$ (depending upon the type of base).



NOTES. All the beams and ties shall be securely held at their remote ends.
Tie beams may have no moment connections.

Figure 10 — Effective length of stanchions
Discontinuous stanchions

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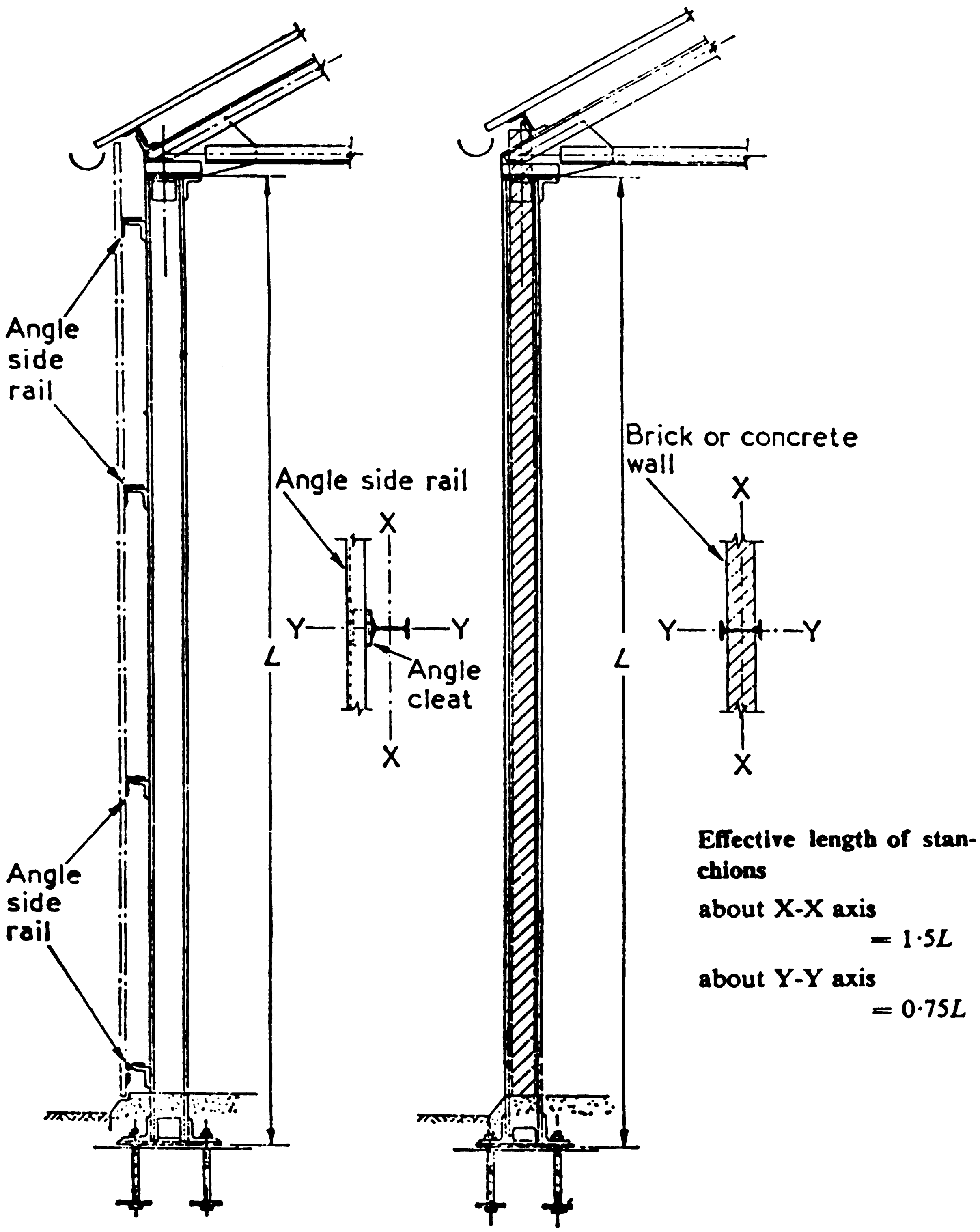

Figure 15 — Effective length of stanchions
Side stanchions in single storey building

Effective length of stanchion.

Axis X-X = $1{\cdot}5L$

Axis Y-Y = $0{\cdot}75L_1$ or $0{\cdot}75L_2$ whichever is the greater.

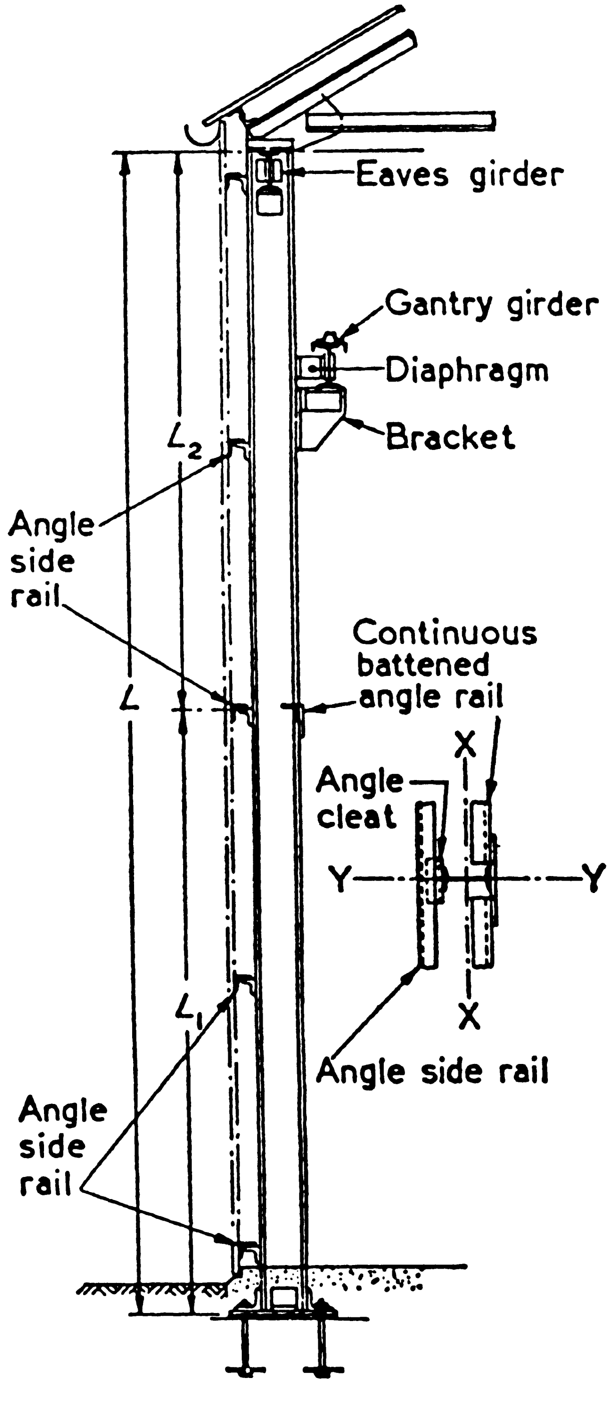

Figure 16 — Effective length of stanchions
Side stanchions in single storey building with crane gantry

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Effective length of stanchions.

Roof stanchion R.

Axis X-X = $1{\cdot}5L_1$

Axis B-B = L_2, L_3, L_4 or L_5 whichever is the greatest.

Crane stanchion C.

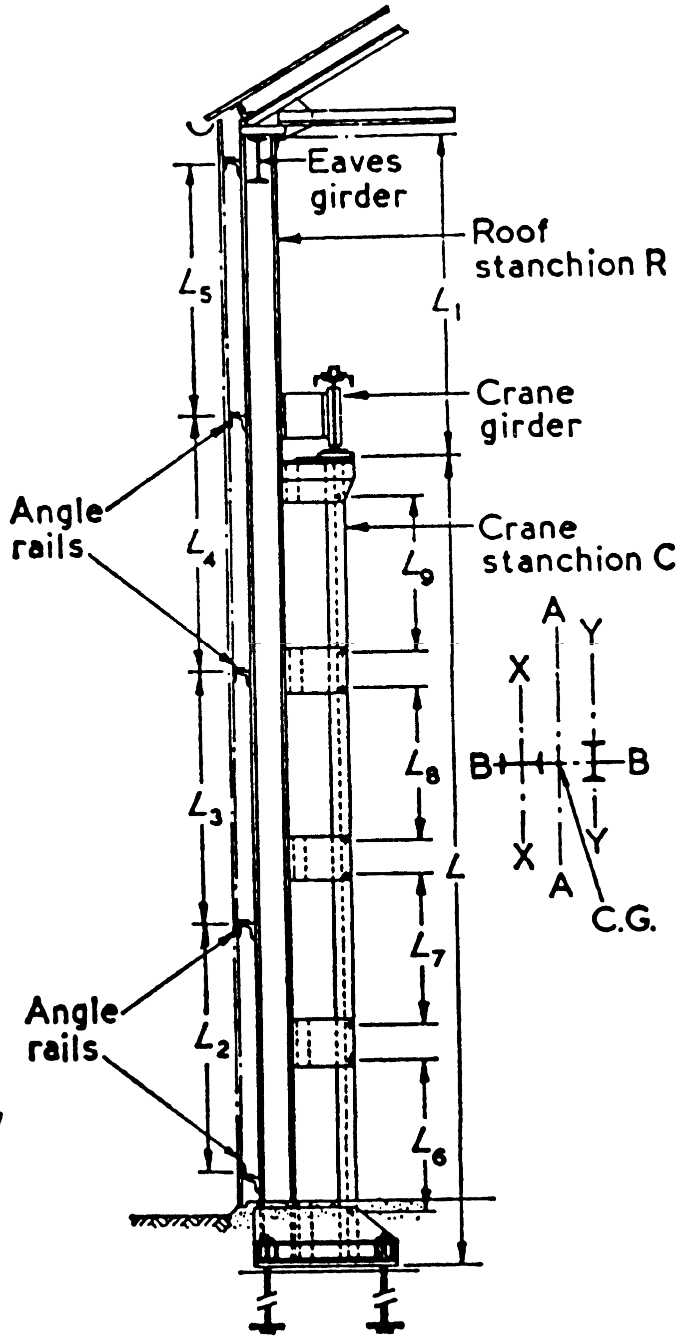
Axis B-B = $0{\cdot}85L$

Axis Y-Y = L_6, L_7, L_8 or L_9 whichever is the greatest.

Combined roof stanchion R and crane stanchion C.

Axis A-A = $1{\cdot}5L$

Axis B-B = $0{\cdot}85L$



NOTE. Lengths L_6, L_7, L_8 and L_9 are the distances between the leading rivets in the batten plates or gussets.

Figure 18 — Effective length of stanchions
Side stanchions in single storey building with crane gantry

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Effective length of stanchions.

Roof stanchion R.

Axis B_1-B_1 = L_1

Axis A-A = $1{\cdot}5L_1$

For the separate channels about axis Y_1-Y_1 use L_7, L_8 or L_9 whichever is the greatest.

Crane stanchion C.

Axis B-B = $0{\cdot}85L$

Axis Y-Y = L_2, L_3, L_4, L_5 or L_6 whichever is the greatest.

Combined crane stanchion C.

Axis A-A = $1{\cdot}5L$

Axis B-B = $0{\cdot}85L$

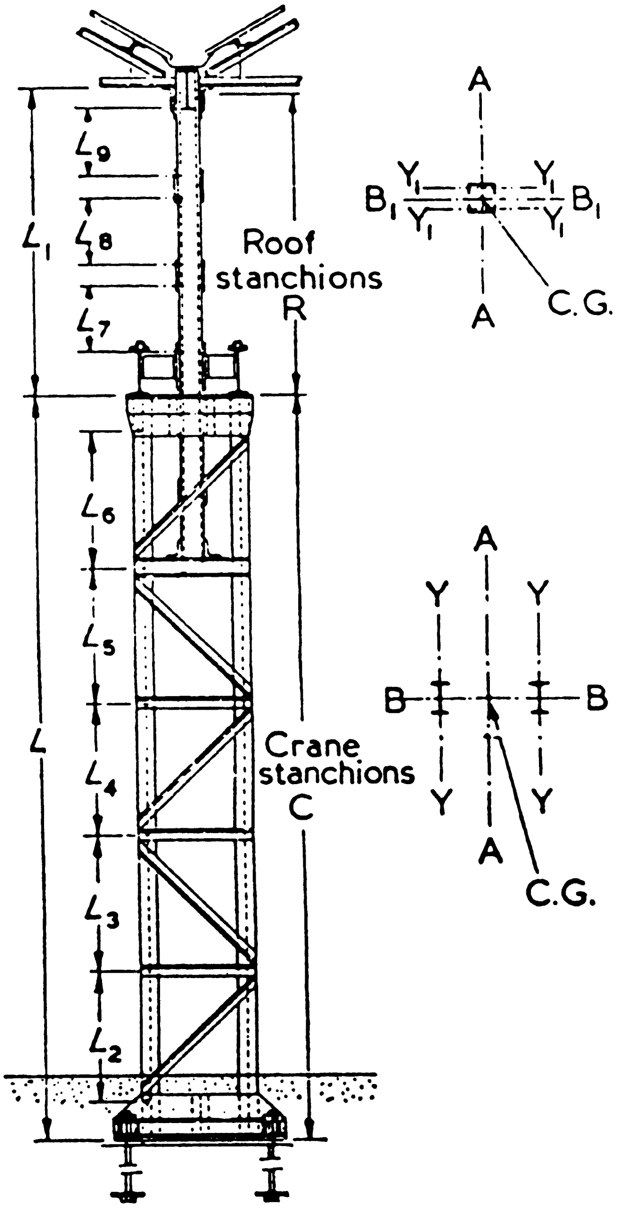

Figure 20 — Effective length of stanchions
Valley stanchion in single storey building with crane gantries

Appendix E General recommendations for steelwork tenders and contracts

The following recommendations are based on the former Code of Practice CP 113, "The structural use of steel in buildings", and are in line with those generally adopted for steelwork construction. They are given in this appendix for general information.

The recommendations in this appendix do not form part of the requirements of the standard and compliance with them is not necessary for the purpose of complying with B.S. 449.

The recommendations in this appendix are unsuitable for inclusion as a block requirement in a contract, but in drawing up a contract the points mentioned should be given consideration.

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E.1 Exchange of information

Before the steelwork design is commenced, the building designer should be satisfied that the planning of the building, its dimensions and other principal factors, meet the requirements of the building owner and comply with the regulations of all authorities concerned. Collaboration of building designer and steelwork designer should begin at the outset of the project by joint consideration of the planning and such questions as the stanchion spacing, materials to be used for the construction, and depth of basement.

E.2 Information required by the steelwork designer

a) **General.**

i) Site plans showing in plan and elevation the proposed location and main dimensions of the building or structure.

ii) Ground levels, existing and proposed.

iii) Particulars of buildings or other obstructions which may have to remain on the actual site of the new building or structure during the erection of the steelwork.

iv) Particulars of adjacent buildings affecting, or affected by, the new work.

v) Stipulation regarding the erection sequence or time schedule.

vi) Conditions affecting the position or continuity of members.

vii) Limits of length and weight of steel members in transit and erection.

viii) Drawings of the substructure, proposed or existing, showing:

1) Levels of stanchion foundations, if already determined.

2) Any details affecting the stanchion bases or anchor bolts.

3) Permissible bearing pressure on the foundation.

4) Provisions for grouting, see Clause **76**.

In the case of new work, the substructure should be designed in accordance with the relevant codes dealing with foundations and substructure.

ix) The maximum wind velocity appropriate to the site. See CP 3:Chapter V, "Loading".

x) Reference to bye-laws and regulations affecting the steelwork design and construction.

b) **Further information relating to buildings.**

i) Plans of the floors and roof with principal dimensions, elevations and cross sections showing heights between floor levels.

ii) The occupancy of the floors and the positions of any special loads should be given.

iii) The building drawings, which should be fully dimensioned, should preferably be to scale of 1 to 100 and should show all stairs, fire-escapes, lifts, etc., suspended ceilings, flues, and ducts for heating and ventilating. Doors and windows should be shown, as the openings may be taken into account in the computation of dead load.

Requirements should be given in respect of any maximum depth of beams or minimum head room.

Large-scale details should be given of any special features affecting the steelwork.

iv) The inclusive weight per square metre of walls, floors, roofs, suspended ceilings, stairs and partitions, or particulars of their construction and finish for the computation of dead load.

The plans should indicate the floors which are to be designed to carry partitions. Where the layout of partitions is not known, or a given layout is liable to alteration, these facts should be specially noted so that allowance can be made for partitions in any position (see CP 3:Chapter V, "Loading").

v) The superimposed loads on the floors appropriate to the occupancy, as given in CP 3:Chapter V, "Loading", or as otherwise required.

Details of special loads from cranes, runways, tips, lifts, bunkers, tanks, plant and equipment.

vi) The grade of fire resistance appropriate to the occupancy, as given in CP 3:Chapter IV, "Precautions against fire", or as otherwise required.

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E.3 Information required by tender (if not also the designer)

a) **General.**

i) All information listed under 2 *a*) above.

ii) Climatic condition at site — seasonal variations of temperature, humidity, wind velocity and direction.

iii) Nature of soil. Results of the investigation of sub-soils at site of building or structure.

iv) Accessibility of site and details of power supply.

v) Whether the steelwork contractor will be required to survey the site and set out or check, the building or structure lines, foundations and levels.

vi) Setting-out plan of foundations stanchions and levels of bases.

vii) Cross-sections and elevations of the steel structure, as necessary, with large-scale details of special features.

viii) Whether the connections are to be bolted, riveted or welded. Particular attention should be drawn to connections of a special nature such as turned bolts, high strength friction grip bolts, long rivets and overhead welds.

ix) Quality of steel, see Clause **3**, and provisions for identification.

x) Requirements in respect of protective paintings at works and on site; galvanizing or cement wash.

xi) Approximate dates for commencement and completion of erection.

xii) Details of any tests which have to be made during the course of erection or upon completion.

xiii) Schedule of quantities.

Where the tenderer is required to take off quantities, a list should be given of the principal items to be included in the schedule.

b) **Further information relating to buildings.**

i) Schedule of stanchions giving sizes, lengths and typical details of brackets, joints, etc.

ii) Plan of grillages, showing sizes, lengths and levels of grillage beams and particulars of any stiffeners required.

iii) Plans of floor beams showing sizes, levels, eccentricities and end moments. The beam reactions and details of the type of connection required should be shown on the plans.

iv) Plan of roof steelwork. For a flat roof the plan should give particulars similar to those of a floor plan. Where the roof is pitched, details should be given of trusses, portals, purlins, bracing, etc.

v) The steelwork drawings should preferably be to a scale of 1 to 100 and should give identification marks against all members.

vi) Particulars of holes required for services, pipes, machinery fixings, etc. Such holes should preferably be drilled at works.

E.4 Detailing

In addition to the number of copies of the approved drawings or details required under the contract, dimensioned shop drawings or details should be submitted in duplicate to the Engineer who should retain one copy and return the other to the steel suppliers or fabricators with any comments.

E.5 Time schedule

As the dates on which subsequent trades can commence depend on the progress of erection of the steel framing, the time schedule for the latter should be carefully drawn up and agreed by the parties concerned at a joint meeting.

E.6 Procedure on site

The steelwork contractor should be responsible for the positioning and levelling of all steelwork. Any checking or approval of the setting out by the general contractor or the Engineer should not relieve the steelwork contractor of his responsibilities in this respect.

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E.7 Inspection

a) **Access to contractor's works.** The contractor should afford facilities for the inspection of the work at all stages.

b) **Inspection of fabrication.** Unless otherwise agreed this inspection should be carried out at the place of fabrication. The contractor should be responsible for the accuracy of the work and for any error which may be subsequently discovered.

c) **Inspection on site.** To facilitate inspection the contractor should, during all working hours, have a foreman or properly accredited charge hand available on the site, together with a complete set of contract drawings and any further drawings and instructions which may have been issued from time to time.

E.8 Maintenance

a) **General.** Where steelwork is to bc encased in solid concrete, brickwork or masonry, the question of maintenance should not arise, but where steelwork is to bc housed in hollow fire protection or is to be unprotected, particularly where the steelwork is exposed to a corroding agent, the question of painting or protective treatment of the steelwork should bc given careful consideration at the construction stage, having regard to the special circumstances of the case.

b) **Connections.** Where connections arc exposed to a corroding agent they should bc periodically inspected, and any corroded parts should bc thoroughly cleaned and painted.

Where bolted connections are not solidly encased and are subject to vibratory effects of machinery or plant, they should be periodically inspected and all bolts tightened.

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List of references

This standard makes reference to the following British Standards and Codes of Practice.

BS 4, *Structural steel sections.*

BS 4-1, *Hot rolled sections.*

BS 499, *Welding terms and symbols.*

BS 592, *Carbon steel castings for general engineering purposes (included in BS 3100 — Steel castings for general engineering purposes).*

BS 639, *Covered electrodes for the manual metal-arc welding of carbon and carbon manganese steels.*

BS 1719, *Classification, coding and marking of covered electrodes for metal-arc welding.*

BS 1881, *Methods of testing concrete.*

BS 2573, *Rules for the design of cranes.*

BS 2573-1, *Specification classification, stress calculations and design criteria for structures.*

BS 2853, *Specification for the design and testing of steel overhead runway beams.*

BS 3100, *Specification for steel castings for general engineering purposes.*

BS 3692, *ISO metric precision hexagon bolts, screws and nuts.*

BS 4190, *ISO metric black hexagon bolts, screws and nuts.*

BS 4320, *Metal washers for general engineering purposes. Metric series.*

BS 4360, *Weldable structural steels.*

BS 4395, *High strength friction grip bolts and associated nuts and washers for structural engineering. Metric series.*

BS 4449, *Hot rolled steel bars for the reinforcement of concrete.*

BS 4482, *Hard drawn mild steel wire for the reinforcement of concrete.*

BS 4483, *Steel fabric for the reinforcement of concrete.*

BS 4604, *The use of high strength friction grip bolts in structural steelwork. Metric series.*

BS 4620, *Rivets for general engineering purposes. Metric series.*

BS 4870, *Approval testing of welding procedures.*

BS 4871, *Approval testing of welders working to approved welding procedures.*

BS 4872, *Approval testing of welders when welding procedure approval is not required.*

BS 4933, *ISO metric black cup and countersunk head bolts and screws with hexagon nuts.*

BS 5135, *Metal-arc welding of carbon and carbon-manganese steels.*

BS 6399, *Loading for buildings.*

PD 4064, *Addendum No.1 to BS 449-2:1969 The use of cold formed steel sections in building.*

CP 3, *Code of basic data for the design of buildings.*

CP 3-Chapter IV, *Precautions against fire.*

CP 3-Chapter V, *Loading.*

PD 3343, *Recommendations for design (Supplement No.1 to BS 449).*

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